JONATHAN HOUSE (K9986-1)

Nailing the Snail That Harbors a Fish Parasite

To kill parasite-harboring snails, fishery biologist Andrew Mitchell and maintenance worker Robert Ideker (driving tractor) apply a solution of copper sulfate and citric acid along the shoreline of an experimental catfish pond.

The American white pelican will fly into the lower Mississippi River Delta again this winter to feed on fish. Its bright orange bill and a pouch that swells when it eats, combined with its short legs and typical wingspan of more than 9 feet, make it quite a spectacle.

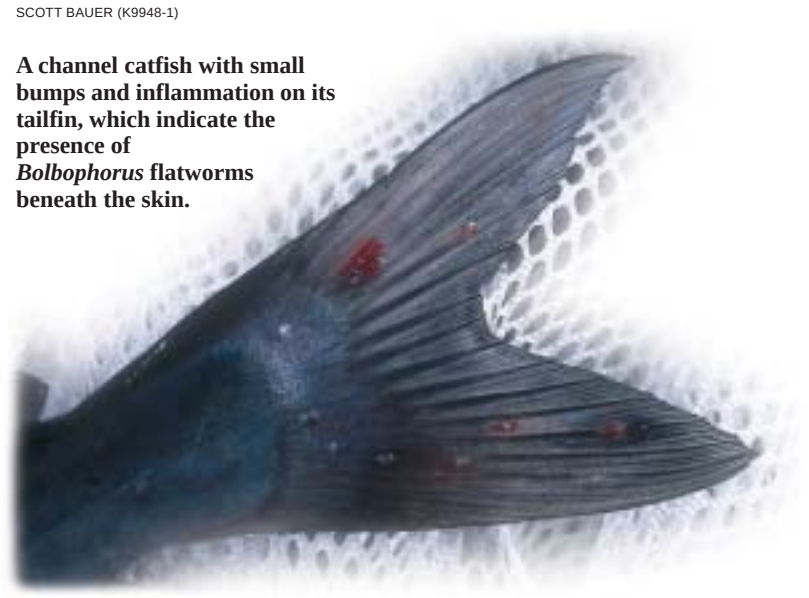
But its appearance isn't what makes an impression on catfish farmers. The pelican also unwittingly harbors a small parasitic flatworm that—once it makes its way into channel catfish—can have a big financial impact on the Delta catfish industry.

The flatworm, *Bolbophorus confusus*, lives in the bird's intestinal tract. Eggs from the flatworm are shed into channel catfish ponds, where they hatch and form larvae that infect an intermediate host, the ram's-horn snail, *Planorbella trivolvis*. Once the larvae multiply and mature inside the snail, they exit and find fish to infect. The cycle begins again when a pelican eats an infected fish and the flatworm reaches maturity inside the bird.

"It's called a complex life cycle," says Andrew J. Mitchell, a fishery biologist at the Harry K. Dupree Stuttgart National Aquaculture Research Center in Stuttgart, Arkansas. "The flatworm must have all three hosts to continue. It's interesting that if only one larva penetrates a snail, it can multiply into tens of thousands of larvae through asexual reproduction. It doesn't take a lot to get the cycle going."

A ram's-horn snail typically measures slightly more than one-third of an inch across. As a carrier of this deadly fish parasite, it is a strong link in a chain of events leading to extensive losses for catfish farmers. Fish infected with *B. confusus* develop small cysts in their flesh, often seen as bumps

SCOTT BAUER (K9948-1)



A channel catfish with small bumps and inflammation on its tailfin, which indicate the presence of *Bolbophorus* flatworms beneath the skin.

just below the skin. The disease can kill smaller fish, and it lessens the appetites of larger fish not killed. This leads to slower-than-normal growth, which makes them unsuitable for market and susceptible to other diseases.

Breaking the Chain

Cases of the disease were first seen in the Delta in 1999. Currently, there is no cure for infected fish. Losses for catfish producers are estimated to be in the millions.

Mitchell determined that if he could reduce the snail population, he could control the disease by breaking the parasite's life cycle midway through. The flatworms cannot be transmitted from one fish to another. Control of the pelican, a nationally protected bird, is not an option.

Mitchell developed a chemical combination to target the freshwater snail. The treatment has proven very effective at reducing the threat of the parasite to farm-raised channel catfish nationwide, including those in Mississippi, Louisiana, Arkansas, and most recently California.

Channel catfish are the most commonly raised food fish species in the United States. Fingerling, or juvenile catfish, deaths can exceed 90 percent in ponds affected by the flatworm. Mitchell says several farms have lost entire ponds of fry (baby catfish) and fingerlings because of severe infections.

Stopping Snails in Their Tracks

Mitchell's treatment is to apply a formula of copper sulfate and citric acid to the waters at the edge of production ponds. The snails live and breed in these shallow waters, where they graze on the microscopic life coating aquatic vegetation, small rocks, and hardened mud surfaces.

The concentrated treatment kills the snails, then quickly dilutes as it disperses throughout the water, according to Mitchell. The troublesome flatworms die when their host snails die. Catfish naturally avoid the treated areas, and by the time the chemical combination spreads throughout the entire pond, it won't harm them.

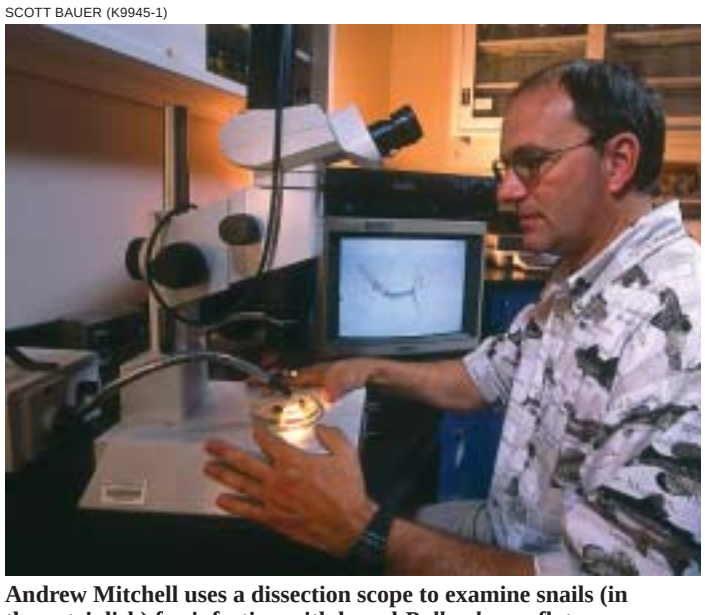
The formula consists of 10 pounds of copper sulfate plus 1 pound of citric acid, mixed with at least 70 gallons of water, for each 250 feet of shoreline. In experimental trials, the treatment was carried in a 110-gallon tank mounted on a tractor and sprayed through a hose. A plastic pipe at the end of the hose distributes the formula over a strip of land and water near the pond's edge. Mitchell says that farmers in the field use 1,000-gallon tanks mounted on trailers to disperse the treatment.

Ninety-five to 100 percent of snails were killed in studies when the water temperature was between 73.4˚F and 86˚F. Treatment effectiveness and fish safety also depend on variables such as alkalinity and temperature of the water. Wind speed is a factor, too, because it may stir up the water so much that the formula is not retained long enough to be effective. Fish size as well as pond size, shape, and depth also play roles in the treatment's effectiveness.

"Copper sulfate had been commonly used in the past to curb the growth of troublesome algae blooms in fish ponds," Mitchell says. "The copper sulfate-citric acid treatment was approved for use against snails by the Environmental Protection Agency, and it is already being widely used in Arkansas and Mississippi for this purpose."

As a result, Mitchell says, the state of Arkansas has not had a serious snail infestation since late in the summer of 1999. He says credit can also be given to Asian black carp, which have been used to eat ram's-horn snails. But black carp might be restricted because of fears that it will escape fish ponds, enter natural waters, and consume threatened or endangered snails and mussels.

SCOTT BAUER (K9945-1)



Andrew Mitchell uses a dissection scope to examine snails (in the petri dish) for infection with larval *Bolbophorus* flatworms. A single larva shows up on the monitor behind him.

A lime treatment developed under a cooperative research program at the Thad Cochran National Warmwater Aquaculture Center in Stoneville, Mississippi, has also had considerable success as a snail treatment and is being further evaluated.—By **Jim Core,** ARS.

This research is part of Aquaculture, an ARS National Program (#106) described on the World Wide Web at http://www.nps.ars.usda.gov.

Andrew J. Mitchell is at the USDA-ARS Harry K. Dupree Stuttgart National Aquaculture Research Center, 2955 Highway 130 East, Stuttgart, AR 72160; phone (870) 673-4483, fax (870) 673-7710, e-mail dmitchell@spa.ars.usda.gov. ◆